# Designing for Instant Convenience: Dark Stores, Spatial Control and Worker Quantification in On-demand Delivery Platforms

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## Abstract

This paper critically examines the design practices of platforms like DoorDash that promise to deliver convenience to consumers' doorsteps within minutes. Based on ethnographic observations in DoorDash dark stores and qualitative interviews with DoorDash workers, we find that instant delivery platforms have several worker- and customer-specific impacts due to how platforms govern space and broader geographies. These platforms computationally remap city spaces to reorient and accelerate the flow of goods and people across them, subsequently exacerbating intra-urban disparities in access to food and groceries. Such centralized surveillance and management of space is made possible through hyper-quantified labor processes that severely limit worker agency inside dark stores and intensify working conditions. Furthermore, minute-tracking of worker output and mobilities, and their hyper-quantified evaluations eclipse much of the invisible work that sustains the veneer of instant deliveries. In arguing for a worker-centered design of gig platforms and their service delivery models, we end with three crucial dimensions that critical design researchers and platform designers need to account for when making things 'convenient.'

## CCS Concepts

• **Human-centered computing** → **HCI theory, concepts and models**; **Empirical studies in HCI**; *Field studies.*

## Keywords

Gig work, Hyperfast deliveries, Dark stores, Socio-spatial justice, Platform design, Worker quantification

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## 1 Introduction

Scholars have long drawn attention to aspects of control, surveillance, unequal power relations, and labor precarity associated with gig platforms [32, 73, 89, 95]. Platforms by design impact work conditions, through increased information asymmetries [30, 69], lack of autonomy due to algorithmic management [39, 46], and panoptic surveillance regimes that affect worker privacy and data rights [72, 98]. Others, including HCI scholars, map countertechniques of design that instill labor agency [18, 37, 50]. Many of these issues have been investigated in the context of gig-based delivery work [43], some highlighting the infrastructural role of gig workers in the delivery of essential goods and services [82]. We add to this scholarship by focusing on a form of delivery work that has grown in the wake of the Covid-19 pandemic – instant delivery of convenience goods through platforms such as DoorDash, GoPuff, Getir and Zepto. We explore design approaches and strategies that underlie instant deliveries and discuss the implications of these on workers associated with these platforms.

By instant delivery we refer to platform services where convenience goods are brought to our doorsteps within minutes. Instant delivery platforms assert greater control over city-wide flows of goods and people, which warrants more research and scrutiny [31, 42, 93]. These platforms rely on a network of digitally managed mini-warehouses: 'dark stores' [64, 94] that stock inventories of up to 4,000 products and through which the platforms fulfill hyperlocal deliveries at unprecedented speeds. Operating on scales far smaller than the more commonplace Amazon or Walmart warehouses, urban neighborhoods are increasingly being populated by dark stores to capitalize on the growing demand for quick convenience at the click of a button [80]. In the immediate aftermath of the pandemic, up to 115 dark stores dotted New York City, many displacing street bodegas [58].

Central to capitalist economies due to its role in circulation (of goods, labor, capital, and information), logistics intertwines with various aspects of our everyday lives, forming the invisible infrastructure that brings us things like food, groceries, medicines, fuel, clothes, and everything in between. As consumption expands, cities across the world are being increasingly reorganized around a process which LeCavalier calls 'logistification', that 'works to flatten, connect, smooth, and lubricate as it organizes material in both space and time' [45, p. 6]. The proliferation of dark stores indicates an intensification of this logistification process as cities are managed to maximize the velocity with which goods, information, people, and signals flow through them. While LeCavalier's research concerned Walmart and its retail empire, dark stores represent a deepening of logistification to make doorstep deliveries possible within minutes. The expansion of instant delivery platforms, therefore, is made possible by new kinds of physical infrastructures and associated labor regimes, both of which are minimally visible. Limited research has explored the design and operational logics that power instant



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deliveries and the subsequent implications for gig workers and city spaces.

Previous research on food and grocery delivery platforms has highlighted both aspirational benefits and critical risks. In addition to comfort, speed, and a wider choice of baskets, scholars have speculated on the potential of platforms to address unequal access to food caused by historical inequities, such as segregation and redlining [17, 29, 49]. On the contrary, popular media includes report on adverse impacts of dark-store-based delivery on urban community life and small businesses, both of which face alienation and redundancy as people retreat to shopping from their homes and platform-operated warehouse spaces crowd out other neighborhood-level establishments [36, 94]. This study adds to this scant yet dispersed literature through an in-depth study of DashMart, DoorDash's on-demand delivery service, in Southeast Michigan.

Labor on digital platforms is not simply limited to the independent-contractor relationship that has dominated much research on gig work [23, 95]. As platforms grow, they mediate newer forms of employment, such as warehouse work, thus evolving to exert control and surveillance in new ways. Instant deliveries require the typical gigified delivery work. But, they also employ permanent and temporary warehouse workers to oversee and run dark stores This alone arguably renders instant deliveries as a valuable case to foresee and understand platform expansion.

Founded and incorporated in 2013, DoorDash is the largest food delivery platform in the US, and operates in 32 other countries with its subsidiaries. While the paper is situated in the US, we hope that our findings prompt deeper examinations of how instant deliveries operate across diverse national and urban contexts. We explore the following research questions: ***How does designing for instant convenience impact working conditions of gig workers and socio-spatial equity in urban areas? How can we inform platform design to consider these challenges and promote worker agency?***

We describe how urban space is coded, surveilled, and quantified by platforms for instant delivery of convenience. Drawing primarily on observations of dark stores and qualitative interviews with dark-store employees and delivery workers associated with DoorDash (n = 20), we argue that instant delivery of convenience involves computationally representing cities and reorienting the flow of goods and people. Engaging with HCI scholarship on the spatial and segregatory impacts of gig platforms [13, 88], we show how spatial practices of instant delivery platforms are built upon regimes of intense surveillance and quantification. Such remapping and reorienting of space often serves upper and middle-class consumers who can afford impulse consumption, exacerbating socio-spatial inequality in accessing food and essential goods. Moreover, labor management strategies for instant deliveries severely constrain worker agency. Dark store labor involves repetitive and homogenous tasks focused on generating data, while often overlooking actual labor that goes into maintaining a warehouse and sustaining operations. Decision-making power on curating inventories, onboarding vendors, warehouse supplies and hiring are centralized leading to several frictions in operations and exacerbating work processes. We end with a discussion on three dimensions along which HCI, critical computing and design scholars can reflexively evaluate ubiquitous values like 'convenience' that are ascribed to technological solutions – hidden and devalued labor, cultures of quantification, and exclusionary spatial practices. Based on our findings we also hint towards possible strategies or tweaks that could address the issues stemming from these dimensions.

## 2 Related Works

### 2.1 Impact of platform design on worker autonomy and agency

Gig platforms are often discussed as having twin-sided effects on workers and workplaces [39, 95, 97]. On the one hand, platforms claim to be mere tech intermediaries that smoothen labor market processes and ease transaction costs while simultaneously retaining immense control over work outcomes [15, 23]. Platforms are also claimed to afford unprecedented levels of flexibility, autonomy, and control to workers over working hours and conditions. However, researchers have questioned these claims by underlining the manifold ways in which gig platforms induce and aggravate precarity [75, 84, 96]. Platforms operate using black-boxed algorithms that induce high information asymmetries: such that workers are unaware of how prices are set, how earnings are calculated, penalties or deductions levied on earnings, who their customers would be, or even their places of work [69, 79, 92]. Algorithmic management constrains worker autonomy through systems like customer ratings, a numeric evaluation that workers are given at the end of their service, which is used to match them with future jobs [68, 83]. A low rating, possibly a result of disgruntled customers or even the worker exercising their purported ability to 'be their own boss' by declining tasks, leads to lower work availability and low-paying tasks [4, 85]. Such features severely curtail workers' ability to choose when, where, and how much to work, and for what pay, thereby undercutting promises like flexibility and higher autonomy. Finally, a whole branch of scholarship has also highlighted the elaborate mechanisms of human-algorithmic surveillance that workers are subjected to, with severe implications for data rights and privacy [41, 72, 98].

In addition to these challenges, workers' experiences of gig platforms are also complicated by intersecting vulnerabilities of race, gender, class, and caste [5, 54, 91]. Women's labor market choices often center around structuring paid work and unpaid care responsibilities. Platforms, with their purported promises of flexibility and autonomy, are therefore particularly prescient for women who in theory could have greater control over their work timings [55]. In practice, however, the features discussed above such as high information asymmetries, algorithmic management, and surveillance, compound women's ability to manage paid work and unpaid care responsibilities due to high levels of uncertainties around work times, customers, and earnings. Gig platforms also disproportionately employ workers from marginalized racial and caste backgrounds, while reifying structural and historical inequalities. HCI researchers, for instance, have highlighted how platform algorithms replicate racial biases in determining how much someone gets to work and earn [57].

And finally, a subset of scholarship on gig platforms has specifically focused on logistics and last-mile deliveries, highlighting unique challenges [9, 76]. Delivery workers typically use riskier

modes of transport including motorized or non-motorized two-wheelers [30, 38]. In addition to greater exertion and safety concerns, they also have specific expectations around 'professionalism' which includes preserving the temperature and presentation (in the case of food) or sensitivity while handling delivery goods. Several scholars have highlighted how incentives are deployed as tools to control delivery workers, and others have noted various counter-strategies deployed by workers to reclaim their agency.

We add to this wide scholarship through an empirical case study of instant delivery platforms. We argue that platforms like DoorDash set up an elaborate architecture of spatial control built using data generated from standardized and hyper-quantified work processes. These spatial practices are aimed at controlling the mobilities of people and goods within specific service zones, pointing to the penetration of platform power to urban neighborhoods and streets. Spatial control, as we describe later, serves as a central organizing principle that powers instant deliveries and has implications beyond the workplace.

In the next section, we situate our research within prior HCI scholarship that discusses the spatial implications of gig platforms, and their impact on city-wide experiences of exclusion, discrimination, and inequality.

## 2.2 Geographic impact of gig platforms

With the proliferation of location-based smartphones and internet services, HCI researchers have focused on understanding the impact of location-sharing on end users in domains like gaming [62], online dating [7, 24], and social media platforms like Foursquare [48]. Much of this research, however, speaks to issues of self-presentation, identity formation, and social interaction, and how location-based digital technologies are implicated in each of these through features of anonymity, network effects, and homophily. Spatial or geographic implications of gig platforms has been a relatively understudied domain within HCI research.

Recognizing this gap, recent scholarship has revisited human geography concepts like 'space' and 'place' to understand how these relate to digital technologies. Space is typically associated with the abstract or inanimate – 'the geometrical arrangement' of matter that facilitates movement of things – devoid of social meaning. In contrast, spaces are 'made into' places through human and social exchange that imprint spaces with meaning and value [21]. Digital technologies facilitate 'place-making' by "transforming the way people use and assign meaning to space…" [13]. They allow space to be governed by representing it through "... data structures that sort every aspect of urban space into discrete, searchable, sortable variables…" (ibid).

For a big branch of HCI scholarship, technology is seen as a tool that can support 'more meaningful' place-making strategies [11, 14, 47, 63]. However, as Corbett and Loukissas [13] note using three case studies from platforms like Nextdoor, Yelp, and Zillow, digital technologies also mediate geographic processes of gentrification, by enabling exclusionary desires of upper-class (and often White) urban residents (e.g., segregation). Similarly, Thebault-Spiekar et al [88] discuss how four common geographic processes (such as distance decay, structured variation in population density, spatial homophily, and mental maps) intersect with design choices of gig work platforms to escalate spatial inequality such that platforms like Uber and Taskrabbit function more effectively in regions of high socioeconomic status when compared to others. In addition to these consequences, researchers have also hinted at platform strategies to represent space digitally such that it (and its inhabitants, and more importantly workers) can be tracked and surveilled with greater precision [59]. Exerting control over space, therefore, becomes a key strategy to influence worker performance [35]. Critical geographers have outlined wider implications of digital applications' use of 'location' as a commodity that serves to target users with incentives and information to consume, thereby entangling everyday lives within circuits of capitalist extraction and accumulation [86, 87].

Frameworks sensitive to spatial implications of gig platforms are integral to reimagining social justice. In addition to revealing the multi-axial power wielded by platforms on urban life, they also draw attention to diverse nodes of political practice that could challenge platform power and reinstate agency within local placemaking processes and actors. Importantly, design researchers in HCI have shifted attention to understanding socio-spatial exclusions inherent in platform design, and have extended unique methods such as 'Parody in Place' towards these aims [26].

In this paper, we borrow from and add to this scholarship. We argue that spatial practices of instant delivery platforms prioritize specific regions over others (particularly those with high socioeconomic status), thereby reifying uneven and unequal urban geographies. Additionally, platform control over space, and their 'conceived digital spaces' [59], are built through data produced from worker quantification and surveillance. Instant delivery platforms, therefore, operate on a vicious cycle wherein control over urban space is established and a culture of penetrative surveillance is normalized to deliver convenience for a few, and this surveillance regime, in turn, deepens platform control over spaces and flows. Furthermore, much like recent work in HCI on delivery workers, we highlight how centralized decision-making often overlooks several location-specific factors that are grounded in the lived realities and experiences of workers, ultimately hindering worker productivity and negatively intensifying work conditions.

## 2.3 Worker-centered design in HCI

A third related branch of scholarship that we draw from involves reimagining platform design by centering the lived experiences and realities of workers, and their priorities. Under the umbrella of 'worker-centered design,' HCI researchers have discussed design strategies that subvert the unequal power relations typical of gig work platforms, wherein workers are typified as a 'reserve army' [25, 33, 99]. Instead, these approaches instill autonomy, flexibility, agency, and ownership in the hands of workers or worker-owned/operated collectives. To conceptually distinguish between these counter-approaches to center workers' voices in platform design, scholars have borrowed from Katz' [40] framework of understanding three distinct types of agency [6] – resilience or small everyday acts of getting by that enable workers to overcome daily challenges to their work lives, reworking or focussed strategies in response to specific problems that result in redistribution of power and resources, and finally, resistance whereby structural shifts are

enabled through critical consciousness building and organized action to counter historical inequities.

In the context of platform work, 'resilience' strategies involve small tweaks to platform design or workflow management techniques, or multitudes of support networks that workers develop to sustain their daily worklives [19, 66]. Turkopticon can be thought of as a reworking strategy, wherein Amazon Mechanical Turk workers in collaboration with HCI researchers created a platform to review and rate employers, flipping the imbalance of power typically in favor of the 'requester' of services, and addressing one of the most persistent issues associated with ghostwork–information asymmetries that undercut worker agency [37]. Approaches by researchers like Scholz and Schneider [74] and van Doorn [91, 92] have advocated for platform cooperatives, wherein full or partial ownership over tech and data is instilled in the hands of worker-owned and run cooperatives. Design researchers in HCI have contributed to understanding and expanding each of these strategies of worker agency.

We add to this scholarship by first highlighting the implications of 'designing for instant convenience' on workers and urban regions, and second, by identifying three dimensions of convenience-centric design that need to be addressed to expand worker agency and address socio-spatial equality.

# 3 Methods

## 3.1 Research Sites

This study focuses on DashMart dark stores. DashMart, launched in 2020 and branded as a "new type of convenience store" [44], refers to the use of dark stores by DoorDash to deliver goods at rapid speeds. In-store shopping is replaced with placing orders through the platform, which are assigned to the nearest DashMart. Their locations are decided algorithmically based on property rates, geospatial data on traffic, and road width (McKenzie and Lovett 2022). The order is then assembled, picked, and packed within minutes by 'warehouse associates', then picked up and delivered by 'dashers' within 15-20 minutes. The 'DashMart' service represents DoorDash's foray into owning and operating warehouses that curate both household essentials and 'local favorites'. Currently there are seven DashMart stores in Southeast Michigan (Figure 1).

Southeast Michigan's urbanity is heavily influenced by Detroit's history as a "city with all the problems…" [28]. Growing out of successive waves of migration (both the Great Migration and international immigration), Detroit has experienced racial and working-class tensions and witnessed continuous reimagination – from being the epicenter of the automobile industry, to deindustrialization and white flight, municipal bankruptcy, and its current resurgence as a 'growing tech hub'. Detroit's contemporary history of labor, land, and economy continues to be marred by redlining, resettlement, and privatized redevelopment by city, county, or state officials; and digital technologies have a central role to play in these processes [70, 71]. In terms of access to food and groceries, Southeast Michigan is estimated to have the largest concentration of food deserts, according to a study conducted by MPHI in 2020.

Within this context, platform-based delivery has been speculated as a model that could address intra-regional disparities in food access [17]. We situate the use and implementation of DashMart within this history of uneven socio-spatial development and technosolutionist claims to reveal how platforms reify existing faultlines and erect new ones. The DashMart stores (n=3) we focus on were identified based on proximity to the authors' location but also because they are emblematic of these aforementioned histories and racial and spatial divides.

## 3.2 Observations

Data collection began with moderate participant observation conducted by the first author over a dozen visits to the three DashMart stores between June and November 2023. The primary objective was to capture the lived-experiences, micro-level meanings and interactions that power the rapid delivery of convenience. At each store, the first author established contact with one or two workers who became key informants in facilitating further visits and getting acquainted with other workers. The trust and rapport established with key informants became instrumental in enabling these observations and recruitment for interviews through snowballing.

Each visit ranged between 2-3 hours. In addition to observing work processes, a key goal was to understand how DashMart operates at different times of day. As a result, while most visits were made during the day shifts (between 9 am – 4 pm), the first author also spent several hours with workers during the night shift. Adopting ethnographic tools helped identify key 'nodes' (actors, institutions, people, entities, etc.) and processes (flows of information, capital, goods, people, etc.) that structure DashMart. All workers for the interviews were recruited on-site during ethnographic visits.

## 3.3 Interviews

The first author conducted 20 semi-structured interviews with different kinds of workers associated with the DashMart service in this region (see Table 1 in the Appendix for a detailed description of participants). The objective was to understand how varying kinds of workers are placed within the system, their relative agency in shaping the system, and their different experiences. This includes DashMart employees, hierarchized into three roles: operations associates (OAs) responsible for picking and packing orders, shift leads (supervise the OAs, may also perform tasks related to operations management at the store level), and employees at managerial positions (responsible for overall supervision of the store, regional clusters of stores, liaising with higher level management). We also interviewed delivery workers or dashers associated with DoorDash and plugged into its grocery delivery service.

All interviewees were above 18 years of age. Only workers employed at DashMart/DoorDash for at least six months were interviewed. Workers were within the age range of 20-56 years, which aligns closely with the estimated average age of gig workers in the US (between 18 and 49 years) [3]. Data collection was paused after responses started to reify and confirm previous experiences. Some example questions include: Can you describe a typical day in your life as a DashMart worker? How does DashMart monitor your work? What do you think is the logic behind organizing the store in the way that it is? What are the processes involved in the daily management of the store? What neighborhoods does your store typically deliver to, and how is this determined?

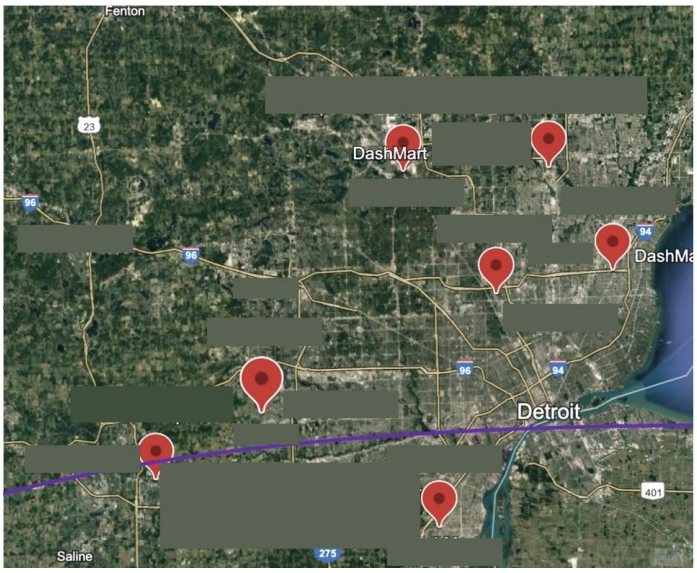


**Figure 1: DashMart store locations in Southeast Michigan. Location names have been removed for anonymity.**

Interviews lasted between 45-75 minutes, with some conducted over two or three sessions to accommodate participants' schedules. For similar reasons, the interviews were scheduled physically on-site, over phone calls, or on online conferencing platforms like Zoom. Participants were paid $30 in compensation for their time. All interview schedules were reviewed and approved by the university Institutional Review Board.

## 3.4 Analysis

All but five interviews were audio-recorded and transcribed. For the remaining five, live notes had to be taken, per participant preferences. Ethnographic observations were recorded as hand-written fieldnotes at first, which were then typed out on the same day.

All transcriptions and fieldnotes were then open-coded using Dovetail. Analysis started with a broad group of deductive codes derived from the interview protocol: 1) Employment and work, 2) Technology and space, and 3) Platform design. We then followed inductive coding to develop an initial group of 94 codes under these broad groups. Several of these codes converged over themes such as: 1) Algorithmic management of space, 2) Centralized control over flows of goods and people, 3) In-store spatial surveillance. Other themes that emerged specific to worker experiences included workers' needs, frictions between operational design of DoorDash and on-ground realities, and unpaid/improvised labor. These themes were used to inform analytical memos, which shaped the findings and discussion presented in the following sections.

## 3.5 Positionality/Ethics Statement

The first author's identity as a recent immigrant, student, and a person-of-color, allowed us to develop rapport with workers, many of whom held similar social positions. Furthermore, they drew from prior research experience to approach participants with added sensitivity and care. All transcripts were anonymized, to respect workers' privacy and maintain trust. The second and third authors also identify as people of color. The second author is a second-generation immigrant and refugee, and grew up in working- and middle-class neighborhoods in the U.S. The third author is a second-generation immigrant who grew up in an upper-middle-class neighborhood in the U.S. We wish to acknowledge the persistent gap in social location between the three authors of this paper, and the workers we interviewed for this study. Research activities like interviews and observations often clashed with working hours, and while extensive care was taken to be minimally disruptive, the process made us all the more conscious of the intense pressures of time that workers dealt with, and the toll these have on their bodies and well-being. Therefore, even though the first author wished to make several repeat visits to review the data and analysis with the workers themselves, this often proved to be a challenge and was ultimately dropped as a strategy. However, we acknowledge this as best practice whenever possible without imposing on workers' time.

# 4 Findings

To address RQ1 (How does designing for instant delivery of convenience impact working conditions for gig workers and socio-spatial equity in urban areas?), we examine how DoorDash's algorithms and management structures impact both clients and workers of DoorDash's services. Section 4.1 sheds light on how the centralized decision-making design of DashMart introduces various 'frictions' in daily store operations, thereby exacerbating working conditions and effort. Section 4.2 outlines the intricate quantification and surveillance regime implemented by DoorDash to power its instant delivery service. And finally, section 4.3 illustrates how DoorDash designs uneven geographies of convenience by algorithmically representing Southeast Michigan into homogenized service zones.

### 4.1 Perils of centralized design in mediating flows of goods and people

Gig platforms have been critiqued for centralization of power through opaque algorithms, information asymmetries and misclassification of workers as independent contractors even while maintaining significant control over work outcomes [23, 41, 69]. On DoorDash, such centralization of power is orchestrated through human managers known as category specialists. DashMart classifies products into categories such as fresh produce, bakery, drinks and soda, munchies, pet supplies, etc. Each product category is surveilled, managed, and mediated by a category specialist who tracks sales, stocks, and orders associated with specific product categories. Workers refer to them as 'DoorDash fairies' or 'DoorDash Gods' to mock how none of them has ever met any of these specialists, and yet they retain such minute control over daily operations. Mangerial employees in our sample described how these category specialists operate at a regional level and remotely manage the flow of goods within DashMarts in Southeast Michigan.

P2, a shift-lead at the Location A store, mentions how this becomes an issue: "...One of the things that is a drag is that it is so removed, like so many people who have never set foot inside my building are deciding things that affect us on the ground floor…" As P3, elaborated:

> "We don't control how much of a product we order or sell. That's all handled by somebody at corporate, they put in all of our merchandise orders… It feels like the biggest issue at the site level. We also don't control sales or promotions [on products]. They decide how sales are handled when it comes to the actual pipeline. All we are doing is handling the product physically and getting it in the door and getting it out the door. And that causes friction."

This 'friction' can lead to a range of issues at the store level – severe space crunch, food waste generation, overstocking or stocking items with low demand, running out of stock for items with high order volumes, etc. On two different visits to the Location A store, the workers were scrambling to 'receive' (a process of algorithmically logging in vendor shipments according to quantity, expiration date, and received date) and store products as they were out of space. On one of these days, P2 mentioned how "....they just dropped off another load of soda and pizzas. Where do I store all these pizza and soda?! No one is buying these pizzas! We have had to throw out all of them from two weeks ago, we still have several left. I want them to come down here and tell me where I can stuff these…" The first author then watched him spend the next half hour clearing up space in existing bins and stocking the excess items atop each other. These numerous improvisations to use storage space are common in DashMart stores, and based on workers' experiential and tacit knowledge of spatial constraints. On another occasion, the first author visited the store at Location B after a thunderstorm had shut off electricity for the neighborhood for over a day. He recorded many improvised ways in which store workers reorganized inventories and the storage area, clearing up fresh produce and using extra space to receive supplies and orders pending for over three days.

In addition to adding to the invisible labor of workers on a daily basis, the frictions caused by the gap between what is perceived from data and excel sheets by category specialists and the reality on the store floor also generates excessive waste: "...It just breaks my heart… Every time we have to throw out all of these pizzas… Nobody orders them. I don't know why they keep sending it to us…" P14 remarked once pointing the first author to a bundle of over three dozen pizzas in their freezers. DashMart workers have no way to give feedback to the specialists, except raising tickets through an automated system (similar to customer service) that workers express is never answered. P6, another operations associate at the Location B store elaborated on the implications of such centralized control over inventories:

> "I thought that was interesting though, that one person is in charge of ordering the items in the store and they're geographically located on the other side of the country. I feel like it would be better if somebody that did the ordering lived in the Midwest and maybe took care of 20 stores… they could connect with small [local] businesses, you would have less items that would be lost out or expired."

As these quotes demonstrate, DoorDash centralized control over the kinds and quantities of goods that are brought into each store, and this level of centralized control is enabled by controlling space inside the dark store. Prior scholarship has noted how digital platforms use a virtually conceived space produced by data capture to surveil gig workers and manage their mobilities across cities [59]. Within DashMart we see these processes of spatial control and surveillance in a system known as 'bin level tracking' (BLT). Under BLT, the warehouse is organized into aisles (as shown in Figure 2) much like in a regular grocery shop. Depending on the area, there may be over 30 such aisles which are further divided into distinct racks (vertical segments) and shelves (horizontal segments). The 'bin,' therefore, is designated by denoting the aisle number, followed by the rack number, and then the shelf which the product is on. Each warehouse has over 1,000 such bin locations, all of which are systematically tracked for their contents, what is put in and what is drawn out. In this way, the storage space within each warehouse is sliced up into homogenous euclidean bins which can be optimally surveilled and tracked to ensure accurate inventories. This system allows an accurate digital map of the store and its inventories to be synchronously updated for the specialists to review, analyze, run predictions, and make decisions.

One of the primary reasons for implementing BLT is to feed constant real-time inventory updates to predictive algorithms that are used by the specialists to centralize control. P10 notes that, "...the system with bin level tracking should be able to take care of itself with inventory as long as we do the counts and make sure it's all correct…" What he means here is that inventory management is offloaded to the algorithm, with the only labor involved being that the algorithm needs to be constantly fed data on the bins to be able to accurately predict their contents. This is done by implementing a process called counting. Every day, each store receives a randomized list of 300 items whose bin locations are specified. Workers have to complete counting, that is, scanning the specified products in



**Figure 2: Aisles and bins inside DashMart**

order for the algorithms to retain their accuracy. Implementing bin-level tracking, therefore, is an extremely labor intensive process and enabled by a culture of pervasive surveillance over workers. Despite this, however, as we have seen previously, centralized management, enabled by BLT, has serious flaws. In spite of real-time surveillance on inventories, DashMart has been unable to curb issues such as waste generation, and overstocking.

## 4.2 Designed to track: Surveillance and worker quantification regimes

Centralization of power through spatial control is made possible by the data reserves produced by intensely quantifying work processes. Work performed by DashMart workers is crucial to producing requisite data reserves that form the base for spatial control and predictive algorithms to operate. As P2 describes,

> "A lot of information is tracked. We can see every edit made to a product so we can see who moved it, who picked it, who received it when it was moved, where it was moved. There's an item history on every single item. We can track all previous purchase orders and all the receiving we've done. Who received it, What date they put in when they received it."

Similarly, P1 explains,

> "Everything we do is either on a computer or on a phone. They have what they call the DashMart Central app, which basically just has everything we do on it. So, like our accounts stocking, moving, you know, anything to do with the stuff is on there. So that's how it's tracked digitally. It's just like everything we do has to be done using a computer."

Work processes thus make dark store space legible to algorithms. Work inside DashMart is divided into tasks, each producing more and more information about goods and products. For instance, inventory management involves receiving products from vendors, verifying their quality and quantity, stocking them into 'bins,' tracking unstocked products, moving incorrectly stocked products, daily counts of inventory stock, inventory audits, removing expired products from stock – and each of these tasks are tracked with painstaking precision using scanners that workers tag around throughout the day.

This infrastructure of control or BLT produced through workers' labor in turn becomes central to monitoring worker productivity and quantifying work processes. To produce constant streams of data about warehouse bins, products, and activities, workers are

under constant and all-encompassing surveillance. DashMart workers are tracked and evaluated on five key quantifications or metrics which ultimately decide the 'rapidness' of an order:

(1) Pick time: time taken to pick one item, calculated from the time an item is tapped on the phone screen to when it is marked as picked, and averaged out over previous 100 picks. Anywhere between 30-60 seconds is considered acceptable.
(2) Pick latency: time between the order being assigned to a workers' queue to when the first item is picked.
(3) Total time spent in picking and packing an order.
(4) Number of items marked as 'not found,' 'missing,' or 'expired.'
(5) Hourly orders picked and packed.

DoorDash institutes a system of three warnings for workers to fail to sustain these metrics. While the first two warnings result in compulsory re-trainings and managerial intervention, workers are automatically fired after the third infraction. Spatial forms of control are also extended to delivery workers outside the DashMart store. DoorDash uses a form of 'spatial zoning' to nudge workers to different areas of the city as demand fluctuates throughout the day or week. P9, a dasher from Location C, shared that DoorDash divides the city into different zones to match the number of dashers in each zone with the order volume across them. These zones (Figure 3) change across a given day, and so do the bonus pay that DoorDash offers across them. In some zones, dashers are offered bonuses as high as $3 and when their base pay is as low as $2.50 bonuses are powerful tools to influence their work decisions and mobilities. As P11, another dasher from Location C explained,

> "They have promotions or certain times you get peak pay, like $3 or $5 on top of your base pay. So certain locations have peak pay, certain locations don't, certain locations have higher peak pay, certain locations have lower peak pay. It depends on which places are very busy… Then there's also the Streak Challenge. If you deliver five orders without declining any, you get a bonus of $8."

Other metrics are also used to track dashers, including delivery times, acceptance rates (number of orders accepted out of the past 100 offered to dashers through their app), order completion rates (number of accepted ordered delivered successfully within time), and customer ratings. 'Star' dashers are those who have ratings above 4.9, acceptance rates above 70 percent and order completion rates over 80 percent are able to work whenever they want, unlike others who have to schedule shifts in advance. When DoorDash assigns an order, dashers have between 30 to 90 seconds to accept the order, post which it is automatically declined, negatively impacting the acceptance rate. A low acceptance rate results in workers' IDs being suspended or terminated. Each of these tactics rarely ever help workers realize the flexibility they desire, that is, control over their working times and autonomy over deciding when and how much to work. Instead, most of these tactics work to ensure that DoorDash has an adequate supply of labor to meet its demand for convenient and quick deliveries, which fluctuate throughout the day and spatially across different regions of the city.

Such spatial and nonspatial strategies of gamification control worker mobilities both inside and outside the DashMart store. Finally, our interviews also revealed that despite such stringent surveillance and quantification strategies to manage labor and space, a whole range of invisible labor in the form of improvisations to tasks, maintenance work, repair work, and tacit experiential knowledge that preserves daily operations (as discussed in Section 4.1) remains unaccounted by DashMart systems.

## 4.3 City-wide uneven geographies of convenience delivery

In addition to these mechanisms of spatial control targeted towards worker quantification and surveillance, DoorDash has other spatial implications at the city scale. When DoorDash enters an urban region like Southeast Michigan, what it sees are spatial dispersed clusters of 'active users':

> "So when we initially plotted DashMarts, one of the things around it was where do we see the most active users… We can look at the time of who has used the DoorDash platform, how many have ordered within a certain area, monthly active users [in that area]... [with] each store that we have, within a certain radius, we touch active users of the DoorDash platform." (P7, Managerial Employee)

These active users are typically consumers who can afford the premium fees associated with hyperfast deliveries, as P15 explains: "You got the delivery fee, [and then] the tip that you have to pay… and then the prices of the items. I don't think they're sold at the same price as regular grocery stores." Since impulse consumption behaviors in the US are inflected along lines of class and race, active users that DoorDash targets are also structured along these demographic lines. For instance, proximity to university campuses was one of the factors that guided decisions around where to open DashMart stores in Southeast Michigan. This was also mentioned by P4, who is the manager for the Location A store: "They knew that was a smart move to drop [the store] right by [University A]. They knew that being open [at] two in the morning and us having alcohol, they were gonna capitalize off of all these colleges…" We find, therefore, that instant convenience delivery is not extended uniformly to entire Southeast Michigan, but only to neighborhoods that have 'active users' or where impulse consumers are expected. Lower income neighborhoods with households unable to afford platformized grocery delivery, that may have limited digital literacy or digital connectivity, risk being invisiblized to this gaze.

Characterized by a far deeper degree of quantification and algorithmic intervention when compared to legacy retail stores, DoorDash relies on data from its existing 'active users' to determine service zones, or 'enclaves' where DashMart is introduced. The boundaries of these zones are determined by algorithms that compare the feasibility of delivering rapid convenience (cost) against the quota of orders across different neighborhoods (profitability or market size).

Figure 4 shows what a service zone looks like based on active users. What we see in this figure are hexagons, some denser than others. These are clusters of active users. Wherever the density is highest, that neighborhood is prioritized as a possible location for DashMart. What underlies these hexagonal clusters and the 'zones' is network analysis that tends to homogenize population characteristics, assuming that everyone within a hexagonal cluster

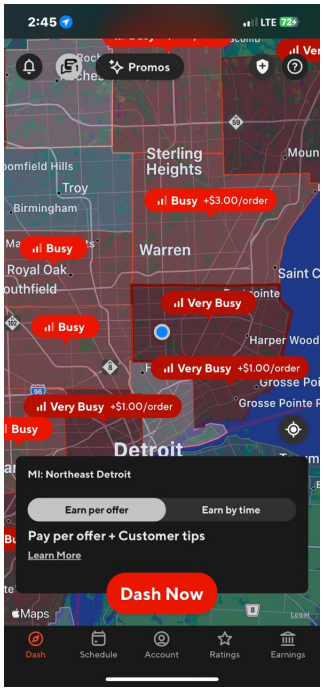


**Figure 3: 'Zones' used by DoorDash to direct dashers to different areas in Southeast Michigan**

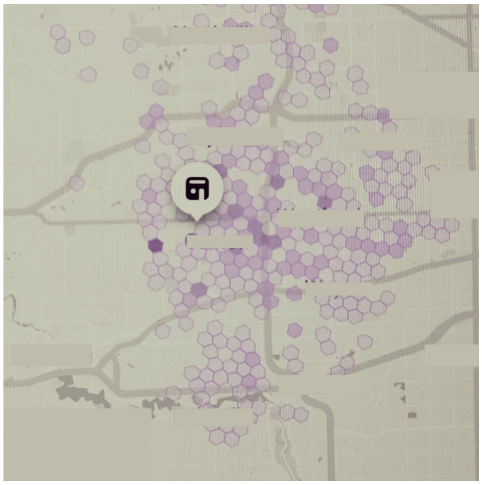

**Figure 4: Service zone for the DashMart store in Location B on the basis of the "most frequent orders". The intensity of colors indicate the frequency of orders from those neighborhoods.**

looks alike, with similar tastes and choices. In so doing, these spatial representations invisiblize those who reside in the in-between spaces within these presumed homogenous zones.

Moreover, store-level inventories are optimized and curated to reflect the tastes of 'active users,' whose preferences and order histories dictate what is labeled and sourced as a 'convenience item.' P8 spoke about how the makeup shades at her DashMart store reflect these trends:

> "Well, I mean look at their makeup choices. Absolutely, I know what their target audience is, they got one shade. It's what you guess, they got one shade."

The products at the Location A store are largely curated to serve university students because of its proximity to campuses. For example, DoorDash launched a Self-Love bouquet as part of its V-Day campaign to promote self-love across select stores all over the US. The bouquet consisted of a bunch of eleven roses plus a sex toy.

The Location A store was selected as one of the sites to test this campaign, as P13 explains:

> "They wanted to see if it sold, and they sold out. Now they have a whole category [of sex toys]. But I [location B] didn't get it. I know Location C doesn't have them. That's why I'm like, certain products will work for every store, [then] why are you just choosing to pick it out for this store? You know, Faygo is a Detroit brand. They carry a Faygo ice cream line and it's very local. I don't have it. Why?"

As P13 suspects, DoorDash's inventories at each store is specialized to target consumers who are computationally identified as most likely to consume them. However, oftentimes these decisions exclude the preferences of large portions of the local population.

DoorDash's algorithms aggregate tastes and preferences over time, and therefore, over a prolonged time in Location A the choices made by this subset dominate and are prioritized over others by the algorithm. Simply put, if college students buy certain sex toys, Location A will stock only those. When DoorDash expands these design logics to all consumer goods and groceries, certain tastes prevail while others are excluded. Location A, therefore, becomes all about 'college students.' P17 mentions this while talking about how their store has stopped stocking kale since it does not cater to their 'clientele.' Specialized inventories based on predictive algorithms lead to choices tailored to the desires of specific consumer groups. Since purchasing power in suburban US is starkly divided along class (and racial) lines, coupled with existing inequalities in digital access and literacy, the kinds of products which platforms curate as 'groceries' and 'convenience products' will be tailored to reflect the tastes of elite (White) citizens. While we found no direct evidence of racialized inventories being stocked across different stores, P13 suspects that this might be happening as an unintended consequence of how DashMart is currently designed and operates. He elaborates this further in his interview:

> "Chips are in everybody's top three [product categories]. Us colored folks, we want spice. Here [in Location B], those flavors doesn't sell as much. But I'm in a white area with a lot of retired folk. Who wants Xxtra Flamin' Hot Cheetos?! You'll find this funny, while they have all that Flaming Hot variety and I have some, but you go in my Lay's section, I got every flavor of Lays potato chips on the market that I ain't seen in [Location A]."

These approaches to platform design are particularly alarming when understood in the context of DoorDash's future plans with DashMart. P7 alluded to this briefly during his interview: "...we're also in a shadowy way [partnering] either with other businesses or services to act them out [have them use our space] in our space. So we're trying to see how we can kind of capitalize on [the] square footage within each Dashmart…" This was also confirmed by other interviewees who mentioned how DashMart stores currently also serve as warehouse hubs for Starbucks and Krispy Kreme. If platforms like DoorDash plan to leverage their algorithmic control over city spaces, and export such control as a saleable service to supermarkets, retail outlets, and grocery chains, several of these exclusionary and racialized logics will be magnified manifold.

Therefore, as instant delivery services continue to grow, their spatial practices at the city scale can homogenize consumer profiles and aggravate issues of equitable access to basic goods and services. We wish to heavily emphasize this finding and hope to confirm this through future research with consumers around experiences with instant grocery deliveries.

## 5 Discussion

Post Covid-19 'convenience' has emerged as a prominent value (with diverse cultural interpretations) to organize platform-based services from convenient rides, to groceries, haircuts, and more. [16, 60]. Centered around notions of ease, consumer agency, and in the case of DoorDash, 'speed,' gig platforms are increasingly designed to produce an unequal political economy of 'convenience' through the precaritization of workers [16]. Against this background, we respond to prior calls in HCI research for reflexive examinations into intended and unintended values that undergird tech systems and their subsequent implications for social life [77]. Our findings reveal that 'convenience' as a value on gig platforms is produced through (i) the intense quantification of workflows and surveillance systems that meticulously track workers, and (ii) the computational representations of city spaces that flatten urban diversity. The design of instant deliveries promotes convenience for a few at the cost of precaritization and exclusion of others. In many ways, these findings resonate with prior research on tech systems that reveals how "seamless convenience" and "frictionless design" undergird a deep political economy of devalued and invisiblized labor [22, 81]. We add to this scholarship by illustrating how the unequal political economy of convenience is anchored by invisible spatial practices that platforms impose on urban environments.

Several other scholars, specifically within the DIS community, have advocated for "designing with friction"—both to visiblize negative implications of prioritizing efficiency and seamlessness; and to reimagine alternatives that promote 'slowness' and are environmentally and socially less disruptive [20, 22, 34, 65]. In line with these approaches, we discuss three dimensions along which design researchers and platform designers can critically reflect while aiming to make things 'convenient.': invisible and devalued labor, surveillance and work quantification, and, spatial control and resultant inequalities. We also highlight recommendations based on our case study of dark stores. Several of our recommendations are tweaks that platform designers can incorporate within their current business and operational models to smoothen on-ground processes, while increasing worker agency. Others are directed towards critical design researchers and the DIS community as rubrics or best practices.

### 5.1 Convenience entails a range of additional and often invisiblized labor

As our findings demonstrate, centrally managing the warehouse through category specialists introduces several kinds of additional labors that ultimately impede efficiency on the warehouse floor. Prior research has confirmed that gig workers in general engage in a wide range of invisible tasks and activities that remain unaccounted for by platforms and their algorithmic gaze [32, 90]. Fox et

**Table 1: Dimensions to critically reflect on convenience-centered design and subsequent recommendations**

| Dimension | Recommendation |
|---|---|
| Invisible and devalued labor | • Assess current approaches to 'convenient design' to excavate all forms of quantifiable and non-quantifiable work that sustains their implementation<br>• Promote decentralized decision-making, specifically around daily store-level processes like placing supply orders, on-boarding vendors, etc., to instill greater control in workers' hands over workloads<br>• Create better channels of communication between store-level employees and higher management to smoothen approvals and daily operations … |
| Intense surveillance and work quantification | • Foster 'slow design' that decentralizes decision-making power, allowing work to be structured and evaluated more organically, rather than through quantified metrics alone.<br>• Re-focus worker management and supervision systems to prioritize health and well-being of workers, rather than unit-level efficiency (of the store).<br>• Engage workers in deciding what kinds of data are useful and whether (and how) such data would be collected, used, stored, and deleted<br>• Critically evaluate contemporary worker-centric sousveillance tools to ensure that cultures of quantification are not reified … |
| Flattened urban diversity and resultant socio-spatial inequality | • Design for open and interactional spaces that preserve agency within neighborhoods and communities<br>• Abandon the assumption that urban complexities can be represented accurately through computational systems<br>• Incorporate workers' experiential knowledge in daily operations and spatial management. |

al. [27] discuss forms of invisible labor as 'patchwork'—the substantial hidden labor that performs essential functions of maintaining, repairing and keeping systems going. Much of these tasks remain unaccounted for but can range from those that enable workers to "get-by", to strategies that become crucial in completing platformized service delivery [27]. Others have interpreted these forms of hidden labor as 'immaterial labor,' or forms of work that result in information, communication, or relationships that become crucial to the production process [67].

Among drivers on on-demand platforms, for instance, these forms of labor can be interpreted as efforts that workers put in to present themselves as 'professional,' like appearing cordial and friendly to earn better ratings from consumers, and effort spent in planning between rides and waiting for customers (ibid). In the case of DashMart, dark store workers engage in a wide range of tasks that sustain operations during moments of breakdown, from everyday supply discrepancies to more extreme emergencies. Other HCI research on location-based gig work notes how spatial management strategies and design logics of delivery platforms ignore workers' lived realities, thereby aggravating their well-being and bodily needs [68, 78].

Following this scholarship and our findings, we recommend design researchers and platform designers to not just be conscious of, but also develop strategies that both visiblize and ultimately curtail such hidden and devalued labor. Platform companies and designers can do so with straightforward, pragmatic strategies that decentralize the managerial and operational hierarchies. Within DashMart this would translate to extending greater voice to dark store employees and workers over daily processes including greater decision making power over placing inventory orders, purchasing supplies and other materials, and onboarding local businesses as vendors. Unlike awaiting directions and approvals from centralized category specialists, workers can better streamline inventory flows while being alert of spatial constraints such as storage area. Such operations design that is better attuned to on-the-ground realities of workers has rewards beyond promoting worker well-being. From a business and operations management perspective, such tweaks curtail waste generation and help manage everyday 'frictions.' As our workers noted, these tweaks can also support better preparedness for unforeseen contingencies such as prolonged power cuts or storage space constraints. Such strategies do not challenge the inherently unequal political economy that underlies platform design, but instead create room for everyday worker resilience and agency.

## 5.2 Digitally mediated convenience undergirds a regime of intense surveillance and quantification

DoorDash uses data produced from workers' labor to measure, evaluate and report 'speed,' 'fresh quality,' 'doorstep delivery,' all of which make up the seamless convenience of the entire process. For instance, workers are allowed 30-60 seconds to pick each time, and this is visible on the consumer's phone with alerts and notifications being sent when 'picking' is completed. Any time beyond this is flagged by the algorithm and successive flags could result in disciplinary action against workers. Quantification of work processes and outputs is therefore central to attaining the lightning fast speeds which platforms like DoorDash use to market themselves. Such quantification of work is also instrumental to the coding and classification of space. DashMart work involves constant use of hand-held scanners which become central to surveilling both the store and everyone and everything in it.

As discussed in previous research on Amazon or Walmart warehouses, such surveillance and minute-by-minute tracking of worker outputs and work processes represents a deepening of Taylorist logics of scientific management [2]. Scholars like Ajunwa [1] describe such labor regimes as leading to the rise of the 'quantified worker': one who is not a living human but a collection of measurable data points optimized for productivity and profit. HCI researchers have noted how such 'regimes of counting' [10] pervade gig work models that seek to standardize and homogenize work processes, and ultimately devalue workers efforts. Others contextualize the culture of quantification within wider practices of scientific self-management that modern workplaces and entrepreneurs have adopted in the light of heightened precarity, lack of legal protections, and austerity under neoliberalism [56].

Despite this penetrative surveillance regime, as noted above, dark store workers have to routinely undertake different kinds of hidden or invisible labor that slips by monitoring systems and worker evaluation. In light of this, past HCI scholarship has recommended designing sousveillance tools that enable workers to track these different forms of invisible labors [18]. However, we strongly recommend that designers refrain from developing tools that reify such cultures of quantification. Instead, as Do et al. [18] argue elsewhere, worker-centered 'tracking' should prioritize worker well-being and health.

Following from the previous recommendation, if platforms are to enhance worker agency within dark stores, then by default the regime of panoptic surveillance would have to give way to 'slow design,' and allowing work relationships and responses to be built organically. Such quantification and surveillance curtails workers' abilities to build organic responses as more and more tasks are standardized, homogenized, and sought to be recorded with minute detail. In addition to promoting 'slow design', our study underscores the crucial need for further research into regimes of surveillance and quantification that are increasingly erected to produce customer-centric convenience. Lastly, we resonate with gig worker-focused advocacy that demands more power to workers in deciding what kinds of data are useful and whether and how these should be collected, used, stored, and deleted.

## 5.3 Designing for convenience simplifies urban complexities and imposes homogeneous choices

Instant delivery platforms like DoorDash are recalibrating urban space and labor management strategies to profit from the pandemic-induced boom in demand for doorstep convenience. Findings from this study resonate with HCI scholarship that highlights how price discrimination algorithms on platforms like Uber and Lyft adversely impact neighborhoods of color who are charged significantly higher [61]. A major cause of such adverse impacts is the inability of platform grid systems to account for the lived experiences of workers and communities from diverse neighborhoods, specifically those where structural exclusion and discrimination have rendered public infrastructures such as roads, traffic signals, and housing severely inadequate (ibid). As Corbett and Loukissas note [13], digital mapping technologies possess a representational power that "imposes a quiet tyranny" by ignoring the actors and networks which create everyday space, thereby seeming to present a 'neutral view from nowhere.' This tyrannical assumption legitimizes inequality, discrimination, and bias when veiled by opaque algorithmic systems.

This is evident in the way DoorDash uses predictive algorithms to represent Southeast Michigan into homogenized 'service zones.' Such algorithmic representation of Southeast Michigan hinges on common yet problematic design assumptions. In assuming space as representable through quantifiable andcalculable units, and programmable to smoothen out flows of goods and people, platforms like DoorDash ignore the lived realities of those who inhabit spaces, including workers and urban residents. In Figure 4, we see an example of how DoorDash implements this assumption in its design. The hexagonal clusters around the warehouse in Location B represent pockets where orders are most frequently concentrated. The use of such hexagons to represent space is similar to Uber's model of using hexagonal grid systems to allow granular spatial analysis of data [8].

By their own admission, platforms deem hexagons as most optimal for granular analysis of spatial features, and for computational models [8]. Every hexagonal area is rendered commensurable to every other area across the globe, in a form of euclidean space that is identical everywhere. Underlying these choices to create a computational space is the belief in 'homophily,' the assumption that people who are alike also reside next to each other. Tracing this belief to social engineering experiments, Wendy Chun argues that homophily in analyzing networks, "[treats] racism as a naturally occuring phenomenon… and makes segregation the default…" [12, p. 6] by ignoring those who reside in the in-between spaces that are invisiblized. Highlighting the implications of homophily in designing computational spaces, Chun notes: "Machine learning is filled with 'neighborhood' methods used for pattern recognition... The K nearest neighbor algorithm draws boundaries between data points based on proximity; it presumes that those data points closest to each other geographically/topographically are of the same class" [12, p. 10]. HCI researchers have also noted the interplay of homophily in reinstating racial and class-based divisions across cities on platforms like Uber and TaskRabbit [88]. Thebault-Spikar et al. [88] interpret this issue as 'spatial autocorrelation' such that demographic characteristics of one location impacts outcomes like

prices in neighboring locations. We see this play out in practice in DoorDash's case when the entire region of Location A is treated and curated as a zone for college students. The implications of homophily in algorithmic management is witnessed in the way that the tastes of a subset of consumers is privileged over the general demographic makeup of a region.

Unlike proposed in HCI research elsewhere [17], the current design of grocery delivery platforms are based on invisible and unequal political economies of space and labor, which do not align with addressing social justice issues like food disparities. Spatial practices deployed by platforms, including discriminatory pricing that divert riders to one location or another and spatial zoning to tap into enclaves of demand, reify uneven geographies of infrastructural access. Our third recommendation therefore is for critical design researchers to promote, and platform, designers to adopt what Massey calls 'an open interactional space' that accounts for the lived experiences of neighborhoods and communities, and instills agency in them: "...[within which] there are always connections yet to be made, juxtapositions yet to flower into interaction, relations which may or may not be accomplished..." ([52], p. 11).

The first step towards designing for an open interactional space involves giving up the assumption that urban complexities can be represented in their entirety through computational models [53]; that cities and their diverse infrastructural needs can be managed through algorithms and predictions.

Instead of squarely relying on network analysis and algorithmic predictions to decipher optimal service zones and inventories, platform designers should create space for incorporating non-quantifiable forms of urban knowledges, most importantly, workers' experiential knowledge on communities they serve (ibid). In the context of instant delivery platforms, we argue again that instilling greater agency in the hands of dark store employees and workers would move platform design closer to enabling an open interactional space. This would be facilitated by the embedded and experiential knowledge that workers bring in around stocking locally relevant inventories, extending services to underserved neighborhoods, and hiring more local businesses as vendors.

## 6 Limitations and Future Research

In this paper, we shed light on conditions of work within platform-operated dark stores, how those link to new forms of control exerted through space, and finally, how dark-store-based instant deliveries reinstate unequal access to services in the gig economy. Admittedly, our findings and recommendations are embedded in workers' experiences of the DashMart system, and narrate DoorDash's spatial practices from their standpoint. However, given that many of the workers in our sample have been associated with DashMart since its entry into Southeast Michigan, were instrumental in setting up the dark stores and internal systems, and most importantly, live and work through these systems on a daily basis, we find their grounded experiences to be most valuable in illuminating the material impact of opaque platforms on cities. It is on the basis of these lived realities and workers' interactions with the black-boxed system that we are able to speculate on the implications of instant delivery platforms for intra-urban equity and socio-spatial justice. We aim to stregthen these claims through direct research with consumers in the future. We also recognize value in incorporating voices of platform designers and management teams as recent DIS scholarship has demonstrated [51], and will be considering these in future studies.

Our objective to understand how labor processes are organized within the entire DashMart system, and how control is experienced by workers placed at different managerial levels, led us to interview different kinds of workers, from store managers, to operations associates, and dashers. It is outside the scope of the current paper to compare and contrast perspectives of these different workers, a topic that will again be explored in future research.

## 7 Conclusion

This paper focuses on the design and operational logics of instant delivery platforms, a phenomenon that has received limited attention within HCI. An extension of on-demand delivery platforms, instant deliveries represent an intensification of attributes such as speed, efficiency, and service quality by promising to deliver goods to our doorsteps within minutes. Our findings show that these experiences of convenience, are not extended to everyone alike. Rather, platforms deploy new kinds of spatial representations across cities which computationally divide neighborhoods into homogenous service zones. These findings resonate with prior HCI research on gig platforms and their role in city-wide socio-spatial processes like gentrification and racial discrimination. We also find that these computationally driven spatial practices homogenize population characteristics, ultimately stifling the diversity of inventories and goods across different zones.

A second set of findings discuss the strategies of spatial control and centralization of power deployed by platforms like DoorDash, both inside and outside the dark store. Our research reveals that both spatial control and centralization have implications for working conditions and visibility of labor that maintains store operations. We also gesture towards the linkages between spatial control wielded by platforms, and worker quantification processes. DoorDash's spatial power is based on data reserves developed from meticulous tracking of dark-store labor.

Instant deliveries, therefore, signal a deepening of regimes of surveillance, datafication, and unequal power relations that have historically characterized gig platforms. They are also emblematic of the skewed political economies of convenience reified by gig platforms, and sustained by precaritization of gig workers. Our analysis reveals multiple dimensions along which HCI researchers and platforms could reevaluate values like convenience that are routinely attached to tech systems, based on which we made recommendations to two specific stakeholders: critical design researchers and platform designers. Our research also hints to broader synergies that could arise from worker-centered platform design, including spatially just urban futures. . We hope that this study encourages further explorations into platform-operated physical infrastructures such as dark stores, cloud kitchens, and their implications for the future of work and urbanization.

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